This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-605}{11}} + \sqrt{0}i$$

The solution is Pure Imaginary, which is option D.

A. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

B. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

C. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

D. Pure Imaginary

* This is the correct option!

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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2. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{100}{529}}$$

The solution is Rational, which is option A.

A. Rational

* This is the correct option!

B. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

C. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

D. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\frac{10}{23}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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3. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{25}{361}}$$

The solution is Rational, which is option D.

A. Irrational

These cannot be written as a fraction of Integers.

B. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

C. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

D. Rational

* This is the correct option!

E. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

General Comment: First, you **NEED** to simplify the expression. This question simplifies to $-\frac{5}{19}$.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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4. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-9 + 66i}{-3 - 8i}$$

The solution is $-6.86 - 3.70i$, which is option C.

A. $a \in [-7, -6.5]$ and $b \in [-270.5, -269.5]$

$-6.86 - 270.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [7, 8]$ and $b \in [-3, -0.5]$

$7.60 - 1.73i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-7, -6.5]$ and $b \in [-5, -2.5]$

* $-6.86 - 3.70i$, which is the correct option.

D. $a \in [-502, -500.5]$ and $b \in [-5, -2.5]$

$-501.00 - 3.70i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

E. $a \in [1.5, 4.5]$ and $b \in [-9, -8]$

$3.00 - 8.25i$, which corresponds to just dividing the first term by the first term and the second by the second.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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5. Simplify the expression below and choose the interval the simplification is contained within.

$$4 - 7 \div 17 * 2 - (6 * 19)$$

The solution is -110.824, which is option B.

A. $[-53.69, -53.25]$

-53.647, which corresponds to not distributing a negative correctly.

B. $[-111.58, -110.57]$

* -110.824, which is the correct option.

C. $[-110.65, -109.21]$

-110.206, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[117.44, 117.85]$

117.794, which corresponds to not distributing addition and subtraction correctly.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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6. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{27 - 77i}{6 - 5i}$$

The solution is $8.97 - 5.36i$, which is option E.

A. $a \in [3.5, 5]$ and $b \in [15, 16.5]$

$4.50 + 15.40i$, which corresponds to just dividing the first term by the first term and the second by the second.

B. $a \in [546, 547.5]$ and $b \in [-6.5, -5]$

$547.00 - 5.36i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

C. $a \in [-4, -3]$ and $b \in [-11, -9.5]$

$-3.66 - 9.79i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

D. $a \in [7.5, 9.5]$ and $b \in [-328.5, -326.5]$

$8.97 - 327.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [7.5, 9.5]$ and $b \in [-6.5, -5]$

* $8.97 - 5.36i$, which is the correct option.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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7. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\sqrt{\frac{-567}{9}} + \sqrt{0}i$$

The solution is Pure Imaginary, which is option D.

A. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

B. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

C. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

D. Pure Imaginary

* This is the correct option!

E. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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8. Simplify the expression below and choose the interval the simplification is contained within.

$$1 - 19 \div 20 * 13 - (16 * 2)$$

The solution is -43.350, which is option D.

A. $[-34.07, -25.07]$

-31.073, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[30.93, 34.93]$

32.927, which corresponds to not distributing addition and subtraction correctly.

C. $[-57.7, -48.7]$

-54.700, which corresponds to not distributing a negative correctly.

D. $[-49.35, -36.35]$

* -43.350, which is the correct option.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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9. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(7 - 3i)(-5 - 2i)$$

The solution is $-41 + i$, which is option C.

A. $a \in [-42, -36]$ and $b \in [-1.04, -0.04]$

$-41 - i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-33, -27]$ and $b \in [27.6, 29.73]$

$-29 + 29i$, which corresponds to adding a minus sign in the second term.

C. $a \in [-42, -36]$ and $b \in [0.39, 2.65]$

* $-41 + i$, which is the correct option.

D. $a \in [-37, -32]$ and $b \in [4.68, 7.26]$

$-35 + 6i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

E. $a \in [-33, -27]$ and $b \in [-29.61, -28.87]$

$-29 - 29i$, which corresponds to adding a minus sign in the first term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-8 - 10i)(9 + 5i)$$

The solution is $-22 - 130i$, which is option A.

A. $a \in [-23, -17]$ and $b \in [-132, -123]$

* $-22 - 130i$, which is the correct option.

B. $a \in [-75, -64]$ and $b \in [-55, -49]$

$-72 - 50i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

C. $a \in [-23, -17]$ and $b \in [127, 131]$

$-22 + 130i$, which corresponds to adding a minus sign in both terms.

D. $a \in [-123, -118]$ and $b \in [45, 51]$

$-122 + 50i$, which corresponds to adding a minus sign in the first term.

E. $a \in [-123, -118]$ and $b \in [-55, -49]$

$-122 - 50i$, which corresponds to adding a minus sign in the second term.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.
